

REMARKS

Reconsideration of the subject application is respectfully requested in light of the comments which follow. After entry of the Response dated October 29, 2004, claims 1-3, 5-7 and 10 are pending.

CLAIM REJECTIONS UNDER 35 U.S.C. §103

Claims 1-3, 5-7 and 10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,016,460 to England et al. (hereafter "*England et al.*") in view of U.S. Patent No. 5,126,107 to Darnfors (hereafter "*Darnfors*") on the grounds set forth in paragraph 6 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

The Examiner has maintained the rejection based on the disclosures in *England et al.* in view of *Darnfors*. In the attachment to the Advisory Action, the Examiner indicates that the prior arguments distinguishing the present claims from the cited references have been considered and explains how the rejection based on the combination of cited references is maintained.

Applicants respectfully request reconsideration of the Examiner's position. Specifically, it is respectfully asserted that one of ordinary skill would not be motivated 1) to modify the Si content of alloys disclosed in *England et al.* and 2) to utilize the alloys disclosed in *Darnfors* for finned tubes. The following points, supported by the attached general reference materials, are provided in support of the Applicants' position and in rebuttal to the Examiner's position.

England et al. discloses an oversized, internally finned tube 24 formed with a mandrel 10. Oversized tube 24 has fins 26 and radially overspaced depressions 28.

Figure 5 depicts the oversized diameter pipe. *England et al.* discloses that the oversized internally finned tube was formed of INCOLOY[®] alloy 800HT[®] having a composition as disclosed at column 2, lines 65 et seq. *England et al.* also discloses that other alloys that may be suitable for use with the invention are those "difficult to work alloys" such as alloys with greater than 30 wt % nickel and 10 wt % chromium. See column 5, lines 11-14. Further and importantly for the discussion here, *England et al.* discloses that suitable alloys have a composition that includes 0.0 to 1.0 Si (see page 2, line 68, page 5, line 22 and claim 1).

Darnfors discloses an iron, nickel, chromium base alloy having an austenitic structure. The composition of the alloy is provided at Table 1 in column 2. In addition to Table 1, *Darnfors* discloses in col. 2, lines 41-44 that "Silicon is required in an amount of at least 1.2% in order that a combination effect between silicon and the rare earth metals shall be achieved with reference to the oxidization resistance."

Incoloy 800 HT, which is disclosed in *England et al.*, is a nickel based alloy. It was common knowledge for a person skilled in the art that high contents of Ni in combination with high contents of Si are not favorable for alloys that would be extensively worked. This is due to, for example, the high risk for formation of brittle phases in the material before or possibly during machining into the final shape. In this regard, Applicants note that *England et al.* limits Si to 1.0% to afford workability while exemplary embodiments of the presently claimed metal tube are formed of alloys with Si above *England et al.* yet can still be worked extensively and that examples in the specification include forming by either pilger rolling over a mandrel or drawing over a mandrel. An alloy as presently claimed having such workability is unexpected based on the disclosure in the cited reference.

Inapposite to the above noted common knowledge, the Examiner has proposed increasing the amount of Si in the *England et al.* disclosure. The motivation for such increase is alleged to be in the combination of *England et al.* and *Darnfors*. However, common practice in the art would not have supported such a motivation and proposed combination.

For example, ASM Metals Reference Book, Third Edition, (copy attached) states on page 514, 2nd paragraph that the Si content in Ni-based alloys should be below 0.60 % since higher contents cause cracking of cold-drawn alloys and may cause weld cracking in others. Furthermore, on page 517, 4th paragraph, it is disclosed the effect of Si on the welding properties of Ni-based alloys, clearly stating that wrought materials generally have less than 1% Si.

Both of these teachings in ASM Metals Reference Book are in keeping with the disclosure in *England et al.* In particular, the explicit disclosure in ASM Metals Reference Book, Third Edition is in keeping with the upper Si limit disclosed in *England et al.*

Furthermore, ASM Metals Reference Book, Third Edition recites that Ni-Cr-Alloys are the least resistant to the effect of Si. This statement would imply that since the presently claimed alloy has both a high content of Ni and a high content of Cr, a high content of Si is not favorable. Thus, the implicit disclosure in ASM Metals Reference Book goes against the proposed modification of the Examiner.

Consequently, a person skilled in the art would not have been motivated and would have had no reason to increase the Si content of Incoloy 800HT alloys of *England et al.* for use in the finned tubes according to our application since the

England et al. alloys modified to a higher Si content as proposed are generally understood to not be favorable for the quite substantial machining operations used to achieve the final tube shape. Furthermore, the general understanding as shown above would not suggest or motivate one of ordinary skill to increase the Si content as proposed by the Examiner.

Corresponding arguments are also applicable, where a person skilled in the art would not start with the disclosure in *Darnfors* and modify it as proposed. For example, a person skilled in the art would not try to utilize the alloy in *Darnfors* for finned tubes because the high degree of machining of such an alloy has a high risk of complications during manufacture of the finned tubes.

Again, the presently disclosed alloy is one that actually can produce finned tubes as disclosed in the application, contrary to the common belief. This can, as stated above, not be considered obvious to a person skilled in the art.

Because the proposed combination and/or modifications are a) expressly taught away by the references and the general knowledge in the art and b) have no motivational basis, the rejection is improper and should be withdrawn.

Furthermore, since the teachings in the art and the general understanding of one of ordinary skill would not have led to the proposed modifications resulting in the claimed metal tube, the remaining motivation for the proposed modification is the Examiner's own hindsight reconstruction. However, such motivation is improper as a basis for the rejection. For at least this further reason, the rejection is improper and should be withdrawn.

Claims 1, 2 and 5-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,206,880 to Olsson (hereafter "*Olsson*") in view of U.S. Patent No. 4,478,275 to Ernst (hereafter "*Ernst*"), and further in view of *Darnfors* on the grounds set forth in paragraph 7 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

The Examiner has maintained the rejection based on the disclosures in *Olsson* in view of *Ernst* and further in view of *Darnfors*. In the attachment to the Advisory Action, the Examiner indicates that the prior arguments distinguishing the present claims from the cited references have been considered and explains how the rejection based on the combination of cited references is maintained.

Applicants respectfully request reconsideration of the Examiner's position. Specifically, it is respectfully asserted that one of ordinary skill would not be motivated 1) to modify the alloys disclosed in *Olsson* in view of *Ernst* and further in view of *Darnfors* and 2) to utilize the alloys disclosed in *Darnfors* for finned tubes. The following points, supported by the attached general reference materials, are provided in support of the Applicants' position and in rebuttal to the Examiner's position.

Olsson discloses a tube for a furnace for cracking hydrocarbons (see col. 1, lines 6-7). The tube has an internal profile as illustrated in FIG. 2 and is formed of an alloy having a composition including Cr. 15-30 wt.%, Al 3-10 wt.%, one or more of Y, Zr, Ti, Hf, Ce and Ca up to 1 wt.% and balance Fe. The tubes are coated on the inside by an Al oxide layer (col. 2, lines 5-6). The addition of up to 1 wt.% of one or more of Y, Zr, Ti, Hf, Ce and Ca "have been found to improve the properties of the aluminum oxide layer" (col. 2, lines 44-45).

Ernst discloses a heat pipe for fluidized bed combustors having two distinct coatings spray coated onto a surface (Abstract). The base material in *Ernst* must contain at least one-tenth percent of aluminum and at least one-tenth percent of either silicon, titanium, yttrium or yttrium oxide or some mixture of these materials. These minor constituents aid in the bond between the base metal and the first layer sprayed onto the casing (col. 1, line 66 – col. 2, line 4). An example of a suitable base material is Incoloy 800, having a composition that includes nickel, 30-35%; chromium, 19-23%; carbon, 0.1% max.; manganese, 1.5% max.; aluminum, 0.15-0.6%; titanium 0.15-0.6%; and silicon 1.0% max. (see, col. 3, lines 12 and 21). The balance of the material is iron. It is the last three minor constituents, aluminum, titanium and silicon, "which are important to the later coating operations because of their bond with the coatings" (col. 3, lines 21-28). In other words, a 1.0% max Si (amongst other constituents) is important to the functioning of the invention in *Ernst*.

However, the Examiner is explicitly increasing the amount of Si in the *Ernst* alloy by the proposed combination with *Darnfors*.

As noted by the Examiner, *Olsson* (in view of *Ernst*) does not disclose the specific elemental compositions of the metal alloy tube (see page 6 of the Official Action) The Examiner then relies on the disclosure in *Darnfors* for the alloy composition.

However, *Darnfors* discloses an iron, nickel, chromium base alloy having an austenitic structure. The composition of the alloy is provided at Table 1 in column 2. In addition to Table 1, *Darnfors* discloses in col. 2, lines 41-44 that "Silicon is required in an amount of at least 1.2% in order that a combination effect between silicon and the rare earth metals shall be achieved with reference to the oxidization

resistance.” Thus, the proposed combination is against the express Si limits in both the *Ernst* and *Darnfors* references, e.g., *Darnfors*' Si minimum is above the express maximum in *Ernst* and *Ernst*'s Si maximum is below the express minimum in *Darnfors*.

Further and as previously discussed, Incoloy alloys, which are disclosed in *Ernst*, are a nickel based alloy. It was common knowledge for a person skilled in the art that high contents of Ni in combination with high contents of Si are not favorable for alloys that would be extensively worked. This is due to, for example, the high risk for formation of brittle phases in the material before or possibly during machining into the final shape. In this regard, Applicants note that exemplary embodiments of the presently claimed metal tube are worked extensively and that examples in the specification include forming by either pilger rolling over a mandrel or drawing over a mandrel. Therefore, an alloy as presently claimed having such workability is unexpected based on the disclosure in the cited references.

Inapposite to the above noted common knowledge, the Examiner has proposed increasing the amount of Si in the *Ersnt* disclosure. The motivation for such increase is alleged to be in the combination of *Ernst* and *Darnfors*. However, common practice in the art would not have supported such a motivation and such proposed combination.

For example, ASM Metals Reference Book, Third Edition, (copy attached) states on page 514, 2nd paragraph that the Si content in Ni-based alloys should be below 0.60 % since higher contents cause cracking of cold-drawn alloys and may cause weld cracking in others. Furthermore, on page 517, 4th paragraph, it is

disclosed the effect of Si on the welding properties of Ni-based alloys, clearly stating that wrought materials generally have less than 1% Si.

Both of these teachings in ASM Metals Reference Book are in keeping with the disclosure in *Ernst*, e.g. a 1.0% max Si content.

Furthermore, ASM Metals Reference Book, Third Edition recites that Ni-Cr-Alloys are the least resistant to the effect of Si. This statement would imply that since the presently claimed alloy has both a high content of Ni and a high content of Cr, a high content of Si is not favorable. Thus, the implicit disclosure in ASM Metals Reference Book goes against the proposed modification of the Examiner.

Consequently, a person skilled in the art would not have been motivated and would have had no reason to increase the Si content of Incoloy alloys of *Ernst* for use in the finned tubes according to the present application since the *Ernst* alloys modified to higher Si content as proposed are generally understood to not be favorable for the quite substantial machining operations used to achieve the final tube shape. Furthermore, the general understanding as shown above would not suggest or motivate one of ordinary skill to increase the Si content as proposed by the Examiner.

Thus, one of ordinary skill in the art considering the disclosure in *Olsson* (in view of *Ernst*) and *Darnfors* would not have been motivated to combine the disclosures in the manner suggested.

Because the proposed combination and/or modifications are a) expressly taught away by the references and the general knowledge in the art and b) have no motivational basis, the rejection is improper and should be withdrawn.

Furthermore, since the teachings in the art and the general understanding of one of ordinary skill would not have led to the proposed modifications resulting in the claimed metal tube, the remaining motivation for the proposed modification is the Examiner's own hindsight reconstruction. However, such motivation is improper as a basis for the rejection. For at least this further reason, the rejection is improper and should be withdrawn.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

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P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

By: 

Jeffrey G. Killian
Registration No. 50,891